

# **中国能源科技发展战略**

## **Development Strategies for China's Energy Technologies**

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# 主要内容

- 背景 Background
- 需求预测 Energy Demand Forecast
- 挑战 Challenges
- 战略选择 Strategies

# 一、背景 Background

## 21世纪前半叶中国的社会经济发展目标

China's social-economic development goals in the first half of the 21 century:

(1) 2020年，中国的GDP将要比2000年翻两番；

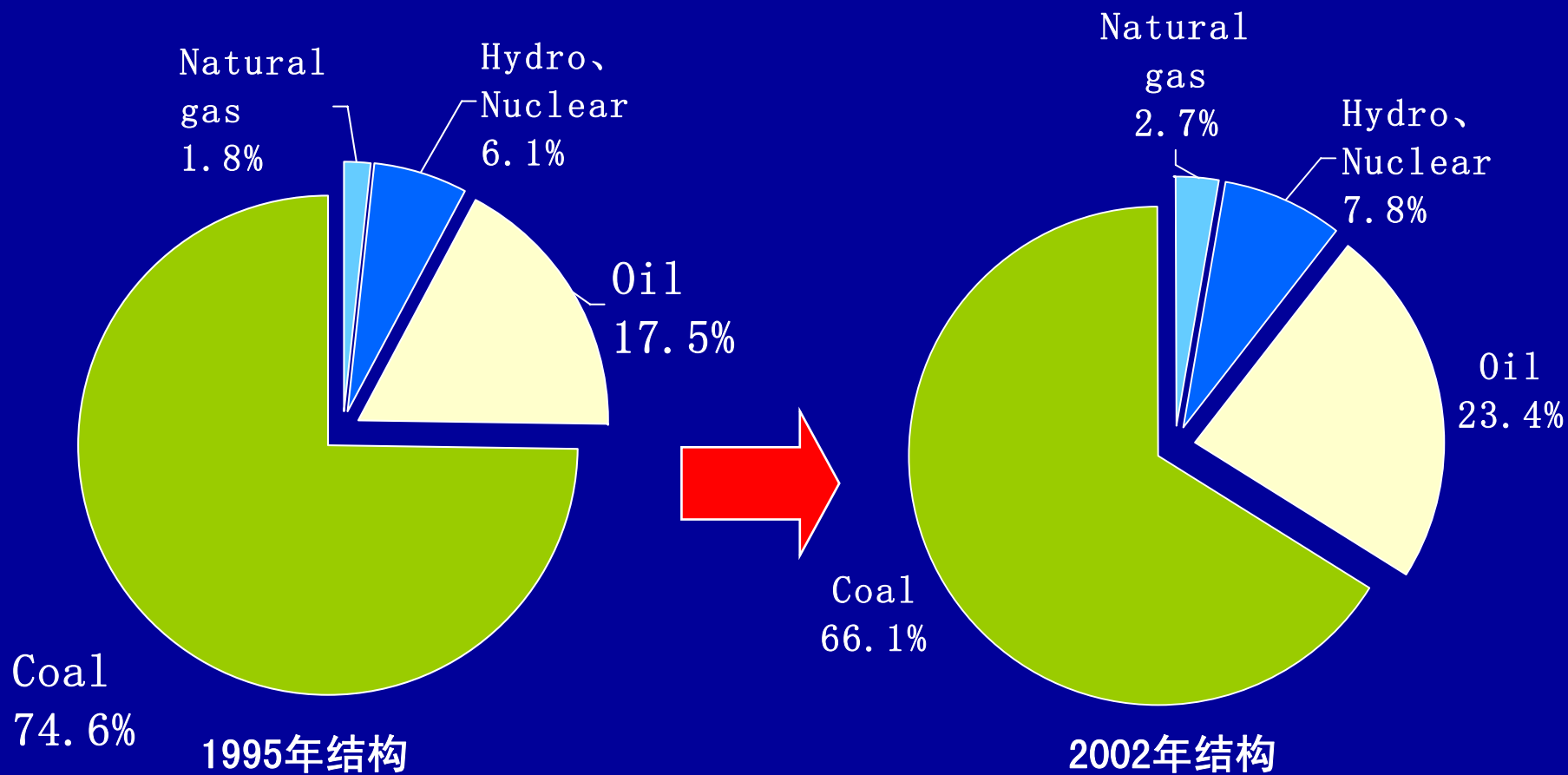
By the year of 2020, building a moderately prosperous society in all respect, and China's GDP quadruple from the 2000 level.

(2) 2050年前后，人均GDP将达10,000美元  
(中等发达国家的水平)。

By the year of 2050, per capita GDP reaches ten-thousand U.S. dollar.

# 能源结构的变化趋势

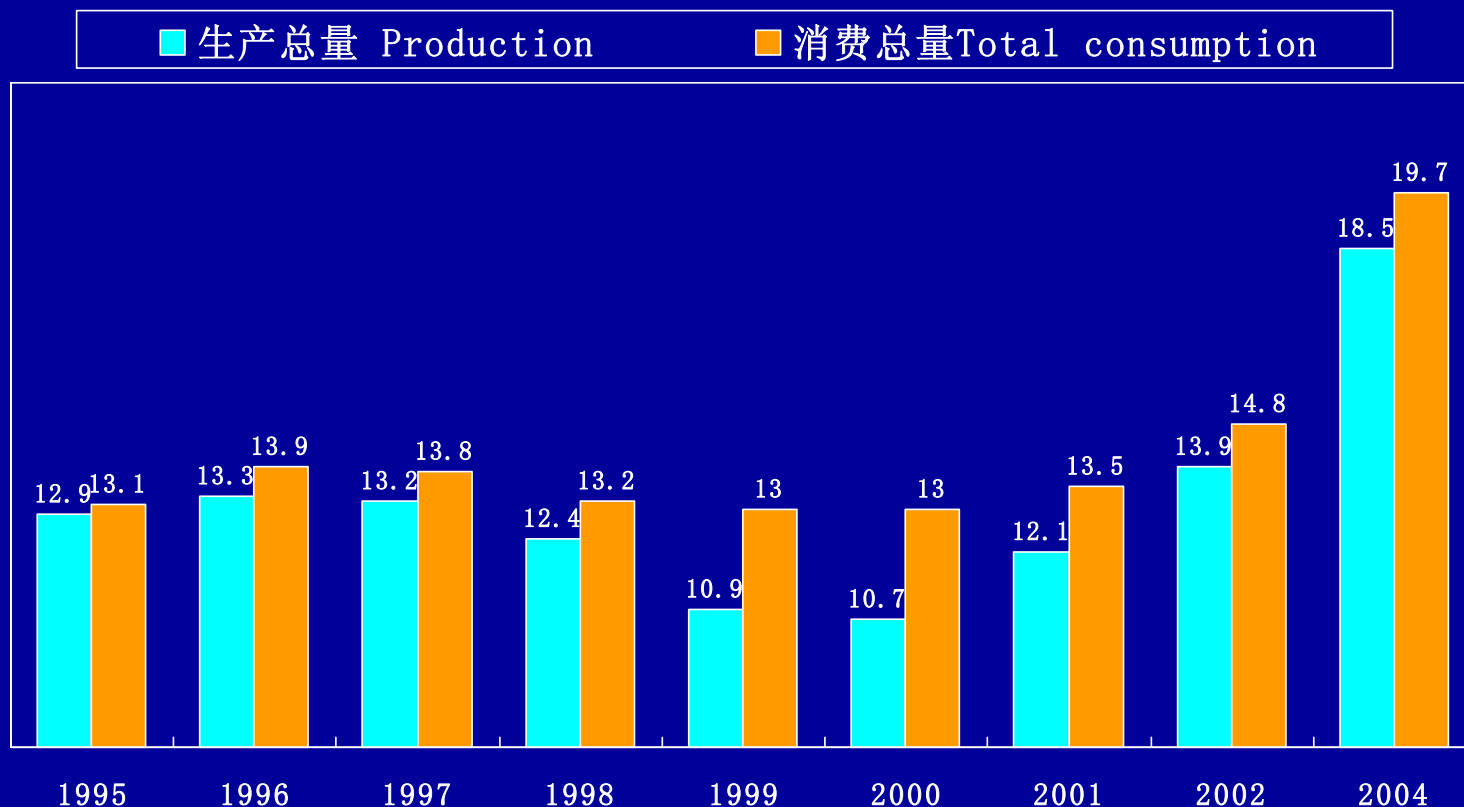
## Energy composition



# 2004年我国能源状况

## China's Energy Production and Use in 2004

- 一次能源消费量为**19.7亿吨**标准煤(世界第二大能源消费国)
- **Primary energy consumption was 1.97 billion ton-coal-equivalent (tce), the second in the world.**



- 一次能源产量为**18.46亿吨**标准煤
- **Primary energy production was 1.846 billion tce**
  - 原煤产量18.7亿吨，居世界第1位
  - **Coal production was 1.87 billion tons, the largest in the world.**
  - 原油1.75亿吨，居世界第5位
  - **Crude oil 175 million tons, the fifth in the world.**
  - 天然气产量415亿立方米，居世界第16位
  - **Natural gas 41.5 billion Nm<sup>3</sup>, the sixteenth in the world.**
- 发电装机容量**4.388亿**千瓦，居世界第2位
- **Installed power generation capacity was 438.8 GW, the 2<sup>nd</sup> in the world.**

## 二、需求预测

### Energy Demand Forecast

- 2020年，我国一次能源需求值在25~33亿吨标煤之间，均值是29亿吨标煤.
- By 2020, China's annual energy demand is about 2.9 billion tce with a range of 2.5-3.3 billion tce, of which,
  - 煤 炭: 21~29亿吨
  - Coal: 2.1-2.9 billion tons
  - 石 油: 4.5~6.1亿吨
  - Oil: 0.45 – 0.61 billion tons
  - 天然气: 1400~1600亿立方米
  - Natural gas: 140-160 billion cubic meters
  - 发电装机容量: 8.6~9.5亿千瓦
  - Installed power generation capacity: 860-950 GW

# 三、挑战 Challenges

## 1、能源供需矛盾突出 Challenges to energy supply

**Not only oil, but also electricity and coal supply**

我国目前人均能源消费约为**1吨**标煤，世界平均值为**2.1吨**标煤，美国**11.7吨**标煤，OECD国家**6.8吨**标煤

China's current per capita energy-use is about 1 tce.

The world average is 2.1 tce, U.S. 11.7 tce, and OECD countries 6.8 tce.



中国人均能源资源量远低于世界平均水平

**China's per capita reserves of major energy resources are far below the world averages:**

石油2.60吨，天然气1074立方米，煤炭90吨，分别为世界平均值的11.1%，4.3%，55.4%

- **Oil: 2.6 ton/person, 11.1% of the world average**
- **Natural gas: 1,074 cubic meters/person, 4.3% of the world average.**
- **Coal: 90 tons/person, 55.4% of the world average.**

## 2、能源安全，尤其是石油安全问题凸现 Emerging energy security issues, especially oil supply

- 到2020年，中国石油消费量将为**4.5~6.1亿吨**，届时国内石油产量为**1.8~2.0亿吨**，对外依存度将达**60%**
- China's annual demand for oil will rise to 0.45 – 0.61 billion tons by 2020, while the domestic production can only supply about 0.18-0.2 billion tons. 60% of China's oil supply will rely on import.

### 3、环境污染严重，可持续发展面临较大压力

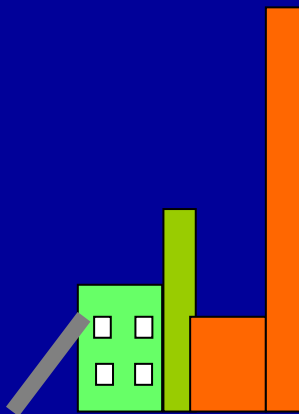
## Severe environmental-pollution problems

Dominant utilization of coal leads to severe pollution

#### Large Quantity

- Direct Combustion
- Low Efficiency
- High Emissions

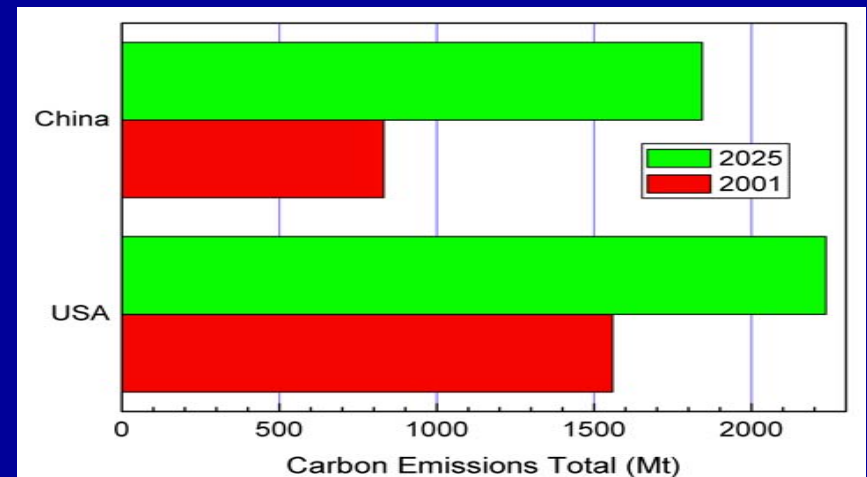
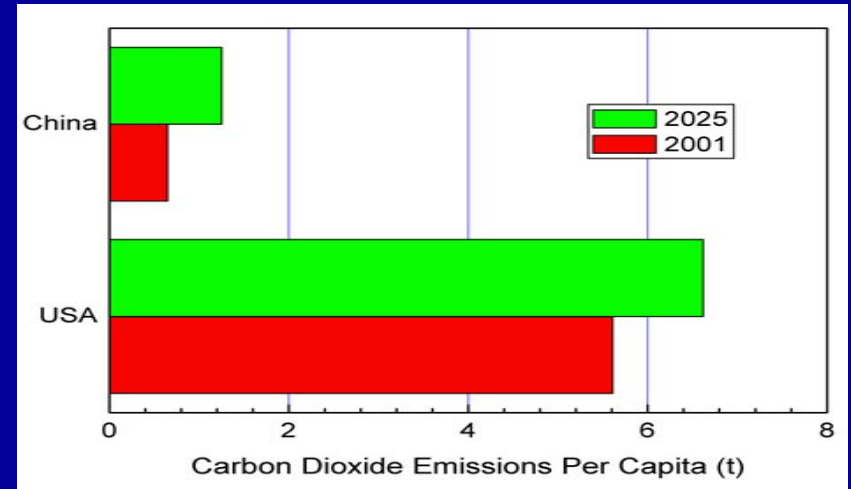
- 70% PM, 90% SO<sub>2</sub>, 67% NO<sub>x</sub>, 82% acid rain
- Externality due to public health deterioration: 7%GDP(1995), 13%GDP(2020)



# 温室气体减排任务艰巨

## Greenhouse gas emission

- In a global point of view, China's per-capita carbon emission is still low.
- But when taken the large population into account, the whole amount ranks the second.



## 四、战略 Responding Strategies

实施“节能优先，供应安全，结构优化，环境友好”的能源发展战略。

**Energy efficiency**

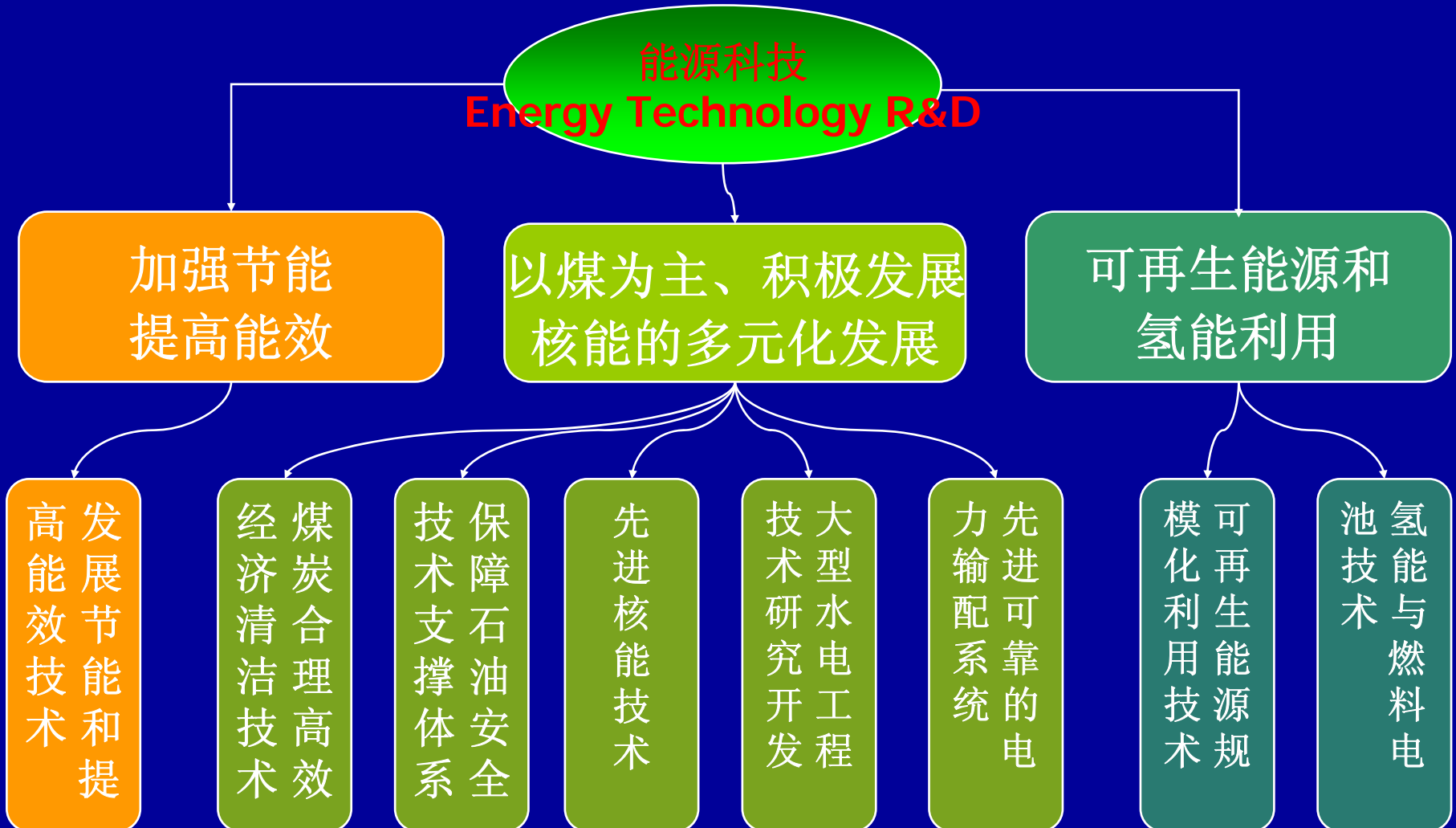
**Supply security**

**Diversified energy**

**Environmental friendly**

# 能源科技发展战略

## Strategies for Research & Development of Energy Technologies



# 1、发展节能和提高能效的技术

## energy-saving and efficiency technologies

■工业部门：采用先进的节能技术、工艺及设备，到2020年节能潜力约1.5~2.0亿吨标煤

■Industrial sectors: China has a potential to save 150-200 million tce by 2020 with the use of advanced energy-saving measures, technologies and processes.

■ 交通领域：推广节油新技术，开发新型高效汽车，实施车辆油耗限制标准等，到2020年节油潜力约7000万吨

■Transportation sector: The saving potential of oil is 70 million tons by 2020 with the use of oil-saving technologies, develop high efficient automobiles, and the adoption of new standards on automobile fuel-efficiency.

■ 建筑领域：开发和推广新型建材和建筑节能综合技术，实施强化建筑节能标准等，到2020年节能潜力约1.6亿吨标煤

■Construction sectors: The energy-saving potential is about 160 million tce by 2020 with the innovation and use of new building materials and energy-saving technologies, and the adoption of energy-efficiency standards for buildings

## 2、煤炭高效、安全、清洁开发利用技术 Clean-coal technologies

- 开发先进煤炭资源勘探和煤矿开采，以及安全生产技术，提高煤炭生产的集中度/ **Research & develop advanced, safe coal-exploration and -mining technologies, and increase scale of coal-production enterprises**
- 近期，发展超临界、超超临界等高效发电技术和污染控制技术，满足电力增长需求/ **In near-term, develop highly-efficient power generation technologies such as super-critical, and ultra-supercritical technologies, and pollution-control technologies**
- 中远期，把以煤气化为基础的多联产技术作为战略选择 / **In the long-term, make coal-gasification-based polygeneration-technology a strategic choice.**



### **3、保障石油安全的技术支撑体系**

#### **Technologic measures to ensure oil security**

- **实现油气勘探理论与技术的创新 / Achieve innovations in theory and technology for exploration of oil and natural gas**
- **研究发展提高油气回收率技术 / R&D on oil and natural gas recovery technologies**
- **开发代用燃料和煤液化技术，开发氢能及燃料电池应用技术 / Develop alternative fuels and coal-liquefaction technologies, hydrogen and fuel-cell technologies**
- **建立石油安全保障体系，包括：战略储备、备用产能、替代能源、预警机制等 / Establish a safeguard system for oil supply that includes strategic reserve, back-up production-capacity, alternative energy, warning mechanisms.**

## 4、先进的核能技术

### **Advanced nuclear energy technologies**

2020年，力争使核电装机容量达到4000万千瓦 / **Installed nuclear-power capacity reach 40 GW by 2020**

■ 掌握百万千瓦级第三代先进压水堆技术，以此作为近中期我国核电发展的主力堆型 / **Develop the third-generation pressurized-water-reactor technologies and adopt it as the primary reactor technology in near and medium-terms**

■ 研究开发以提高核电站的安全性和经济性，核废物最少化为主要目标的第四代核能技术 / **Research & develop the fourth-generation nuclear-reactor that aims at high safety and economic, and minimization of nuclear waste**

■ 积极开展核聚变技术的研究 / **Research on the nuclear fusion technologies**

## 5、大型水电工程技术

### Large-scale hydro-power technologies

保证生态环境，积极发展水电 / **Actively develop ecosystem-friendly hydro-power**

■ 生态环境友好的大型水电工程建设关键科技问题

**Innovation on the key technologies in building ecosystem-friendly large-scale hydro-power projects**

■ 复杂条件下的水电工程建设关键科技问题

**Innovation on key technologies for building hydro-power projects under complex conditions**

■ 大型复杂水电站群的优化规划、调度、评价的理论研究

**Conduct theoretic research on the optimal planning, dispatch, and evaluation of large, complex hydro-power-stations**

## 6、先进可靠的电力输配系统

### **Advanced power transmission & distribution system with high reliability**

- 研发超大容量远距离输电技术，以满足我国西电东送1亿千瓦的要求 / **To meet the need of transmitting 100 GW of power from the west to the east, research & develop long-range power-transmission technologies of huge-capacity including superconducting technologies.**
- 研发超大规模互联电网安全保障和防御体系的理论和技术 / **Research and develop on theory and technologies for safety and protection of super-large power grid**

# 7、可再生能源规模化利用技术

## Renewable energy technologies

可再生能源是我国实现能源可持续发展必由之路  
Renewable energy is the only way of China's sustainable energy system

近期，重点发展风力发电、生物质能、太阳光伏电池、太阳能建筑一体化技术

In near-term, focus on wind power, biomass, PV, and integrated technologies of solar-energy building

## 7、可再生能源规模化利用技术 (1)

### Renewable energy technologies

- 2020年：实现风力发电装机**2000**万kW（占发电量的1%）。我国有风电资源约**10**亿kW（陆上2.5亿kW，海上7.5亿kW）

China has wind-power resource of about 1000 GW (of which, land 250 GW, sea 750 GW). Goals are that wind-power capacity reaches 20 GW by 2020, and that wind-power contributes 1% of the total power generation.

## 7、可再生能源规模化利用技术 (2)

### Renewable energy technologies

- 2020年：生物质发电和生物质液化利用达到**0.5亿吨**标煤（我国有生物质能资源**4.5亿吨**标煤）

China has a bio-energy resource of 0.45 billion tce. Goal is to produce 50 million tce from biomass-power and biomass-liquefaction and biofuels.

## 7、可再生能源规模化利用技术 (3)

### Renewable energy technologies

- 2008年：实现MW级风力发电机组产业化；完成2MW风力发电机组样机研制。
- 2010年：建立海上实验风电场。
- 2008: MW wind-power Generator realized commercial; and Researcher & Development 2MW wind-power Generator .
- 2008: To Built Sea wind-power Test Farm.



## 7、可再生能源规模化利用技术 (4)

### Renewable energy technologies

- 中国太阳能资源十分巨大，利用城市和广阔的戈壁地区发展太阳光伏规模化发电站，2010年前建立3个MW级并网发电站。

**China has a huge resource of solar energy. Gobi and desert areas can be utilized for large-scale PV power generation. And To Built 3 unit MW electricity generation station.**

# 7、可再生能源规模化利用技术（5）

## Renewable energy technologies

- 开发太阳能热发电利用技术，2010年建立MW级太阳能塔式热发电实验站，2020年，建立20MW级太阳能塔式热发电站。
- Developing the technology of power generation from Tower solar thermal and build a demo. Station with MW in 2010.
- To build a demo. Station with 20MW of Tower solar thermal in 2020.

## 8、氢能与燃料电池技术

### Hydrogen and fuel cell technologies

氢能是清洁能源载体，是我国减排CO<sub>2</sub>、降低石油消费的重要途径 / Hydrogen is a clean energy-carrier, and is a fundamental measure to reduce China's reliance on oil and CO<sub>2</sub> emission

■ 研发高效、低成本的制氢及储运技术 / R&D on highly-efficient, low-cost hydrogen production and storage technologies

## 8、氢能与燃料电池技术（1）

### Hydrogen and fuel cell technologies

- 研发车用和固定式氢能燃料电池核心技术及集成技术 / R&D on the core technologies of hydrogen fuel cells for both automobile and stationary uses, and their integration technologies
- 2020年实现在交通等重点领域的规模应用 / Commercial-use of fuel cell technology in transportation sector by 2020.

## 8、氢能与燃料电池技术（2）

### Hydrogen and fuel cell technologies

- 2010年研建30-50kW的SOFC； 200-250 kW的MCFC燃料电池发电系统及集成技术； 2-300W的DMFC燃料电池。 200kW 车用PEMC。
- To built on 30-50kW SOFC and 200-250 kW MCFC and 2-300W DMFC of fuel cells power station in 2010. And 200kW PEMC for Bus.

谢谢！